PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 15 February 2001 (15.02.01)	
International application No. PCT/SE00/01134	**Applicant's or agent's file reference** P9918PC
International filing date (day/month/year) 31 May 2000 (31.05.00)	**Priority date** (day/month/year) 04 June 1999 (04.06.99)
Applicant BRIAND, Danick et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   20 December 2000 (20.12.00)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer R. E. Stoffel
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

ATENT COOPERATION TRE. Y

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

BERGLUND, Erik
Berglunds Patentbyrå AB
Aspebråten
S-590 55 Sturefors
SUÈDE

Date of mailing (day/month/year) 04 October 2001 (04.10.01)	
Applicant's or agent's file reference P9918PC	**IMPORTANT NOTIFICATION**
International application No. PCT/SE00/01134	**International filing date** (day/month/year) 31 May 2000 (31.05.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address

NORDIC SENSOR TECHNOLOGIES AB
Teknikringen 6
S-583 30 Linköping
Sweden

State of Nationality: SE
State of Residence: SE
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address

APPLIEDSENSOR SWEDEN AB
Teknikringen 6
S-583 30 Linköping
Sweden

State of Nationality: SE
State of Residence: SE
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Athina NICKITAS-ETIENNE
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Claims

1. Micro-hotplate device with integrated chemical sensor, which comprises:

a) a support substrate;

b) a supported membrane, attached to said support substrate, extending over a well in said support substrate;

c) an island attached to said membrane so as to be electrically and thermally isolated from said substrate, said island consisting at least partly of a semiconducting material;

d) one or several heating elements integrated in said island;

e) one or several temperature-sensing elements integrated in said island;

f) one or several active microelectronic devices integrated in said island, where at least one of said active microelectronic devices is a chemical sensor whose chemically active layer is exposed to the ambient.

2. A micro-hotplate device according to claim 1, wherein at least one heating element consists of a heating transistor.

3. A micro-hotplate device according to claim 1, wherein at least one heating element consists of a heating resistor.

4. A micro-hotplate device according to any of the claims 1-3, wherein at least one temperature-sensing element is a temperature-sensitive resistor.

5. A micro-hotplate device according to any of the claims 1-3, wherein at least one temperature-sensing element is a temperature-sensitive diode.

6. A micro-hotplate device according to any of the claims 1-5, wherein said membrane consists of one or several insulator layers.

7. A micro-hotplate device according to claim 6, wherein at least one insulator is silicon nitride.

8. A micro-hotplate device according to claim 6 or 7, wherein electrically conducting leads to the active microelectronic devices on the island have been placed between different insulator layers.

9. A micro-hotplate device according to any of the claims 1-8, wherein the semiconducting material in the island is silicon.

10. A micro-hotplate device according to any of the claims 1-8, wherein the semiconducting material in the island is silicon carbide.

11. A micro-hotplate device according to any of the claims 1-10, wherein the support

substrate and the island are made of the same material.

12. A method for the fabrication of a micro-hotplate device according to claim1, **characterized in** the use of a combination of masking steps and etching steps to define the geometry of the device.

13. A method according to claim 12, **characterized in** the use of consecutive backside etching steps comprising:

a) depositing the supporting membrane over the silicon substrate;

b) one etching step is used to define the thickness of the island by etching away the region surrounding the island to a certain wanted depth, equal to the wanted thickness of the island;

c) another etching step is used to etch the island and surrounding region until the island is isolated from the support substrate.

14. A method according to claim 12, **characterized in** the use of a silicon-on-insulator wafer as substrate whereby the buried insulator layer in said silicon-on-insulator wafer is used as an etch stop to define the thickness of the island of the device, resulting in a silicon island with an insulator layer on backside.

15. A method according to claim 14, **characterized in** the use of the following steps:

a) etching away from the front side of the device the region surrounding the island down to the buried insulator layer;

b) etching away from the back side of the device the silicon in the region below the island and the region surrounding the island until the buried insulator layer on the island is exposed and the island is attached to the support by the insulator layer.

16. A method according to claim 14, **characterized by** the following steps:

a) oxidizing the silicon layer on the front side of the device down to the buried insulator layer, except for the region where the island should be;

b) etching away from the front side of the device the oxide in the region surrounding the island until the underlying silicon substrate is exposed;

c etching away from the back side of the device the silicon in the region below the island until the buried insulator layer on the island is exposed and the island is attached to the support by the remaining part of the insulator layer.

17. A method according to any of the claims 12-16, wherin at least one of said etching steps is an anisotropic potassium hydroxide etching step.

18. A method according to any of the claims 12-16, wherein at least one of said etching

steps is an anisotropic tetramethyl ammonium hydroxide etching step.

19. A method according to any of the claims 12-16, at least one of said etching steps is a deep reactive ion etching step.

20. A micro-hotplate device according to any of the claims 1-12, wherein one or several of the chemical sensors utilize the field-effect detection mechanism.

21. A micro-hotplate device according to claim 20, wherein one or several field-effect chemical sensors are combined with one or several chemical sensors that utilize a detection mechanism different from the field effect.

22. A micro-hotplate device according to any of the claims 1-12 or 21, wherein one or several of the chemical sensors are operated as gas sensors.

23. A micro-hotplate device according to claims 21 and 22, wherein one or several field-effect gas sensors are combined with one or several gas sensors that utilize resistance changes as detection mechanism.

24. A micro-hotplate device according to claim 23, wherein at least one of the gas sensors that utilize resistance changes as detection mechanism is made of a semiconducting metal oxide.

25. A micro-hotplate device according to claim 23, wherein at least one of the gas sensors that utilize resistance changes as detection mechanism is made of a polymer.

26. A micro-hotplate device according to any of the claims 1-12 or 20-25, wherein the support substrate contains an array of several islands.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P9918PC	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE00/01134	International filing date *(day/month/year)* 31.05.2000	Priority date *(day/month/year)* 04.06.1999
International Patent Classification (IPC) or national classification and IPC7 G 01 N 27/414, G 01 N 27/18		
Applicant Appliedsensor Sweden AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20.12.2000	20.09.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Bertil Dahl/ELY Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE00/01134

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-6 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☒ the claims:
pages 8 , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages 7,9 , filed with the letter of 03.08.2001

☒ the drawings:
pages 1-2 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE00/01134

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-27	YES
	Claims		NO
Inventive step (IS)	Claims	1-27	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-27	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The present application relates to a micro-hotplate device with integrated chemical sensors and a method for making it. The characterising feature of amended claim 1 is that at least one of the sensors is a gas-sensitive field-effect sensor.

The cited documents WO 94/10822 A1 (D1) and WO 94/10821 (D2) disclose micro-hotplate devices including means for measuring temperature and electric properties of materials during heating.

None of the documents, however, disclose a micro-hotplate device including a gas-sensitive field-effect sensor.

The device and method according to amended claims 1-27 are therefore novel. They are also considered to satisfy the criteria of inventive step, since it becomes possible to use chemical sensors of the gas-sensitive field-effect type in a micro-hotplate device, and industrial applicability.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01134

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01N 27/414, G01N 27/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9410822 A1 (THE UNITED STATES OF AMERICA AS REPRESENTED BY THE UNITED STATES DEPARTMENT OF COMMERCE), 11 May 1994 (11.05.94), page 8, line 2 - line 3; page 3, line 18 - page 4, line 20, figure 5 --	1-26
X	WO 9410821 A1 (UNITED STATES OF AMERICA, AS REPRESENTED BY THE UNITED STATES DEPARTMENT OF COMMERCE), 11 May 1994 (11.05.94), abstract -- --------	1-26

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw douhts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 Sept 2000	09 -10- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Moa Grönkvist/ELY Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.
PCT/SE 00/01134

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9410822 A1	11/05/94	US 5464966 A	07/11/95
WO 9410821 A1	11/05/94	AU 5450194 A	24/05/94
		US 5356756 A	18/10/94